NEMA TS2-Type 1, P Cabinet Assembly
City of San Jose Specification
Rev date. November 20, 2015
A. Cabinet Minimum General Requirements
The cabinet shall be completely wired and tested to the 2003 NEMA Traffic Controller Assemblies specification with NTCIP Requirements Version 02.06 (as amended here in). In addition, and at a minimum, the following requirements shall be met:

City of San Jose traffic signal cabinet specification shall supersede any applicable parts of the State of California, Department of Transportation Standard Specifications and Standard plans. This specification shall apply to all controller cabinet types with noted exceptions.

All items not covered by these specifications shall conform to State of California, Department of Transportation Standard Specifications and Standard Plans. Traffic signal cabinets shall also comply with NEMA specifications where applicable.

1. All cabinets shall be pre-approved by the City of San Jose prior to bid letting.
2. The cabinet shall be designed for 16 channel operation where each load switch socket can be configured for a vehicle phase, pedestrian phase or overlap operation. These load switch sockets shall be configured in this manner without rewiring the back side of the load-bay. BIU load switch drivers 1-16 shall be wired to appropriate load switch sockets via a terminal block located on the front side of the load bay so as to allow checking voltage inputs to the load switch sockets without dropping the load bay.
3. The cabinet shall be wired for up to a minimum of (32) channels of detection, (4) channels of Opticom™ preemption and (4) channels of low priority preemption.
4. The use of PC boards shall not be allowed except in detector racks, SDLC interface panels or BIU cages.
5. The use of plug and play modules shall not be allowed, with the exception of detector rack(s).
6. The cabinet shall be wired to provide a 10-pin “A” connector.
7. All cabinet 120VAC wires shall be 18AWG or greater, including controller “A” and MMU “A & B” cables.
8. The complete cabinet assembly with electronics shall undergo complete input/output function testing by the manufacturer before being released to the City of San Jose.

B. Cabinet Enclosure
At a minimum, the cabinets shall meet the following criteria:

1. It shall have nominal dimensions of 56” high x 44” width x 25.5” depth and meet the footprint dimensions as specified in Section 7.3, Table 7-1 of NEMA TS2 standards for a Type P cabinet. The cabinet base shall have continuously welded interior mounting reinforcement plates with the same anchor bolt hole pattern as the footprint dimensions.
2. Shall be fabricated from 5052-H32 0.125-inch thick aluminum.
3. The cabinet shall be double-flanged where it meets the cabinet door.
4. The top of the cabinet shall be sloped 1” towards the rear to facilitate water runoff. And shall bend at a 90° angle at the front of the cabinet. Lesser slope angles are not allowed.

5. The inside of the cabinet shall utilize C channel rails. (2) Welded on the back wall on 34” center and (4) welded on each side wall on 08” center with 04” between sets. The C channel rails on the back wall shall be 35” in length and start 5” from the bottom of the cabinet interior. The C channel rails on the side walls shall be 48” in length and start 5” from the bottom of the cabinet interior. Adjustable rails are not allowed.

6. The cabinet shall be supplied with the following finishes: the interior powder coat WH-14 (white), the exterior powder coat WH-14 (white).

7. All external fasteners shall be stainless steel. Pop rivets shall not be allowed on any external surface.

8. The door handle shall be ¾” round stock stainless steel bar.

9. The main door shall contain a police door with a conventional police lock. A key shall be provided for both the cabinet lock and the police door lock. The police door shall be recessed into the main door so that the police door is flush with the main door. A closed-cell, neoprene gasket seal shall be bonded to the enclosure doors. A stiffener plate shall be welded across the width of the inside of the main door to prevent flexing. A main door bar stop shall be a two-position, three-point stop that accommodates open-angles at 90, 125, and 150 degrees. A louvered air entrance located at the bottom of the main door shall satisfy NEMA rod entry test requirements for 3R ventilated enclosures. Bearing rollers shall be applied to ends of door latches to discourage metal-on-metal surfaces from rubbing. The lock assembly shall be positioned so handle does not cause interference with key when opening the door.

10. The cabinet shall be equipped with a universal lock bracket capable of accepting a Best™ style lock and a Corbin #2 tumbler series lock. The cabinet shall come equipped with a Corbin #2 lock.

11. The cabinet shall be supplied with two door switches which control the door open status and the cabinet interior lighting circuits.

12. The cabinet shall have a rail road preemption circuit. This circuit shall be 120VAC with input and output to rail road on detector panel. The relay shall be an 11 pin and mounted on the main panel (load bay).

13. All exterior seams shall be manufactured with a neatly formed continuously weld construction. The weld for the police box door shall be done on the inside of the cabinet door. All welds shall be free from burrs, cracks, blowholes or other irregularities.

14. The fan baffle panel seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet.

15. The cabinet shall be UL listed.

16. The cabinet shall come with lifting ears affixed to the upper exterior of the cabinet. These ears shall utilize only one bolt for easy reorientation.

17. The cabinet shall come with a three-stage, multi-ply progressive density polyester, disposable air filter; and the filter performance shall conform to listed UL 900
Class 2 and conform to ASHRAE Standard 52.1. The filter shall be secured to entrance on main door by two (2) horizontally-mounted restraints.

18. The door shall be mounted with a single continuous stainless steel piano hinge that runs the length of the door. The hinge shall be attached via stainless steel tamper resistant bolts.

C. Labels
A permanent printed thermo vinyl, engraved or silk screened label shall be provided for the following equipment:

1. Receptacles for relay and switching devices.
2. Switches, fuses and circuit breakers.
3. All removable plug-in electronics or equipment.

Labels shall be legible and shall not be obstructed by cabinet wiring, panels or cables. All labels shall conform to the designations on the cabinet wiring prints. Labels for all shelf-mounted electronics and equipment shall be on the face of the shelf directly below their placement in the cabinet.

D. Shelves
Cabinet shall come with (3) double beveled shelves 10” deep that are reinforced welded with V channel, fabricated from 5052-H32 0.125-inch thick aluminum with double flanged edges rolled front to back. Slotted hole shall be inserted every 7” for the purpose of tying off wire bundles.

E. Cabinet Layout
The shelves shall be populated as follows.

1. The power supply and (2) detector racks shall be placed on the bottom shelf. The controller and monitor shall be placed on the middle shelf. The top shelf shall be left empty for future electronics.
2. The detector panel for all field inputs shall be located on the lower left wall.
3. The power panel shall be located on the lower right wall.
4. Surge suppressor shall be located on the right wall above the power panel.
5. The SDLC and power supply interface panels shall be located on the left wall between the middle and upper shelves.
6. The 120VAC quad outlets shall be mounted on the right wall, at the top of the “C” channels.
7. Load resistor panel shall be mounted on the left wall under the bottom shelf.
8. One blank panel, populated with a 25-position terminal block on the lower right hand, shall be located on the right side of the cabinet between the surge suppressor and the 120VAC quad outlets. A second blank panel shall be located on the left side above the detector panel and end at the top of the “C” channel.
F. Ventilating Fans
The cabinet shall be provided with two (2) finger safe fans, one mounted on each side of the cabinet plenum, and shall be thermostatically controlled (adjustable between 4-176° Fahrenheit). The safe touch thermostat and power terminal block(s) shall be din rail mounted on right side of cabinet plenum.

G. Computer Shelf
A slide-out computer shelf 16” length by 12” width by 2” depth shall be installed below the middle shelf underneath the controller. The shelf shall be mounted just right of center so that controller cables will not interfere with the operation of the shelf when equipment is installed. The shelf shall have a hinged cover that opens from the front and shall be powder-coated black. It shall be a General Devices Part # VC4080-99-1168 or equivalent. The door when fully extended shall hold up to 50lbs.

H. Main Panel Configuration (Load-Bay)
The design of the panel shall conform to NEMA TS2 Section 5, Terminals and Facilities, unless modified herein. This panel shall be the termination point for the controller unit (CU) MSA, (MMU) MSA & B cables, bus interface units 1 & 2 (BIU) and field terminal facilities. The terminal and facilities layout shall be arranged in a manner that allows all equipment in the cabinet and all screw terminals to be readily accessible by maintenance personnel.

The load-bay shall be fully wired and meet the following requirements:

- The load-bay shall have the following dimensions; constructed from aluminum with a nominal thickness of 0.125 inches, a maximum height of 19” and a maximum width of 37-½ inches including attached wiring bundles.
- The entire assembly shall roll down and provide access to all of the back of panel wiring. All solder terminals shall be accessible when the load-bay is rolled down. The assembly shall be able to roll down without requiring other components, cables or switches to be removed.
- The load-bay shall be designed so that all other cabinet screw terminals are accessible without removing cabinet electronics.
- All the controller (CU) and malfunction management (MMU) cables shall be routed through the back of the load-bay so that they will not be subject to damage during load-bay roll down.
- The top of the load-bay panel shall attach directly to Unistrut™ spring nuts without the use of standoffs and spacers.
- The load-bay shall be balanced such that it will not roll down when the Unistrut™ spring nuts are removed, even when fully loaded with BIUs load switches, flasher and flash transfer relays.
- The load-bay facility shall be wired for 16 channels. Load switch(s) 1-8 shall be vehicle phases 1-8; load switch(s) 9-12 shall be pedestrian phases 2, 4, 6 & 8; load switches 13-16 shall be overlaps A, B, C & D. All load switches shall be routed through a flash transfer relay.
• (16) Load sockets spaced on 2” center per NEMA TS2 section 5.3.1.2, Figure 5-2.
• (8) Flash transfer relay sockets.
• (1) Flasher socket.
• All load switches and flasher shall be supported by a bracket extending at least ½ the length of the load switch.
• (2) Bus interface unit rack slots for BIU’s 1 and 2. The load-bay must have space available for a 3rd BIU. All of the cabinet BIU’s shall fit into one rack in the top left corner of the load-bay. Multiple racks are not allowed.
• BIU wires connection to the PCB shall be two (2) 34 pin connectors. These connectors shall have locking latches.
• All BIU wiring shall be soldered to backside of a screw terminal. The screw terminals provide access to all functions of BIUs.
• Wiring for one Type-16 MMU. All MMU wiring shall be soldered to backside of a screw terminal. The screw terminals provide access to all functions of the MMU.
• All 24 VDC relays shall have the same base socket, but it shall be different from the 115VAC relays.
• All 115VAC relays shall have the same base socket, but it shall be different from the 24VDC relays. (not applicable to flash transfer relays)
• Shall have a relay that drops +24VDC to load switches when the cabinet is in flash.
• There shall be a wire between the pedestrian yellow field terminals and another terminal on the load bay. The MMU channel 9-12 yellows shall terminate next to said pedestrian yellows terminal.
• The load-bay shall be silkscreened on both sides. Silkscreen shall be numbers and functions on the front side, and numbers only on the back side.
• Field wiring terminations shall be per channel across the bottom of the load-bay. Each channel shall have 3 terminations corresponding to the appropriate vehicle phase Red, Yellow and Green. Default wiring shall be left to right vehicle phases 1-8, pedestrian phases 2, 4, 6 & 8 and overlap channels A, B, C & D following the order of the load switches. Field terminals shall be #10 screw terminal and be rated for 600V.
• All cable wires shall be terminated. No tie-off of unused terminals will be allowed.

All wiring shall conform to NEMA TS2 Section 5.2.5 and table 5-1. Conductors shall conform to military specification MIL-W-16878D, Electrical insulated high heat wire, type B. Conductors #14 or larger shall be permitted to be UL type THHN. Main panel wiring shall conform to the following colors and minimum wire sizes:

- Vehicle green load switch output: 14 gauge brown
- Vehicle yellow load switch output: 14 gauge yellow
- Vehicle red load switch output: 14 gauge red
- Pedestrian Don’t Walk switch: 14 gauge orange
- Pedestrian Walk switch: 14 gauge blue
- Pedestrian Clearance load switch: 14 gauge yellow
<table>
<thead>
<tr>
<th>Switch Input</th>
<th>Wire Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle green load switch input</td>
<td>22 gauge brown</td>
</tr>
<tr>
<td>Vehicle yellow load switch input</td>
<td>22 gauge yellow</td>
</tr>
<tr>
<td>Vehicle red load switch input</td>
<td>22 gauge red</td>
</tr>
<tr>
<td>Pedestrian Don’t Walk input</td>
<td>22 gauge orange</td>
</tr>
<tr>
<td>Pedestrian Walk input</td>
<td>22 gauge blue</td>
</tr>
<tr>
<td>Pedestrian Clearance input</td>
<td>22 gauge yellow</td>
</tr>
<tr>
<td>Logic Ground</td>
<td>18 gauge white with red tracer</td>
</tr>
<tr>
<td>+24V DC</td>
<td>18 gauge red with white tracer</td>
</tr>
<tr>
<td>+12V DC</td>
<td>18 gauge pink</td>
</tr>
<tr>
<td>AC+ Line</td>
<td>14 gauge black</td>
</tr>
<tr>
<td>AC- Line</td>
<td>14 gauge white</td>
</tr>
<tr>
<td>Earth Ground</td>
<td>16 gauge green</td>
</tr>
<tr>
<td>AC line (load bay)</td>
<td>12/14 gauge black</td>
</tr>
<tr>
<td>AC neutral (load bay)</td>
<td>12/14 gauge white</td>
</tr>
<tr>
<td>Controller A cables</td>
<td>22 gauge blue with the exception of power wires (AC+ Black, AC- White &amp; Earth Ground Green) These wires shall be 18AWG</td>
</tr>
<tr>
<td>MMU A &amp; B cables</td>
<td>22 gauge orange with the exception of power wires (AC+ Black, AC- White &amp; Earth Ground Green Start Delay Relay Common Black, Normally open Black &amp; Normally Closed Black) These wires shall be 18AWG</td>
</tr>
</tbody>
</table>

Two conductors will supply alternating current (AC) power to the load switch sockets. The load switch sockets shall be supplied alternately (every other socket) by each conductor.

The field terminal blocks shall have a screw Type No. 10 post capable of accepting no less than 3 No. 12 AWG wires fitted with spade connectors. Four (4) 12-position terminal blocks shall be provided in a single row across the bottom of the main panel. Spade lugs from internal cabinet wiring are not allowed on field terminal screws. There shall be a second row of four (4) 12-position terminal blocks with screw type #10 above the field terminal blocks. These blocks shall operate the flash program. It shall be changeable from the front of the load-bay. All load switches, flasher, and flash transfer relay sockets shall be marked and mounted with screws. Rivets and clip-mounting is unacceptable.

The power terminal blocks shall have a screw Type No. 10 post capable of accepting no less than 3 No. 12 AWG wires fitted with spade connectors. One (1) 12-position terminal blocks shall be provided vertically on the right side of the load bay. The placement of the power terminal block on any other panel shall not be allowed.

The load bay field, flash program and power terminals shall have a protective plastic cover. This shall be removable by loosening screws but without removing screws.
Wire size 16 AWG or smaller at solder joints shall be hooked or looped around the eyelet or terminal block post prior to soldering to ensure circuit integrity. All wires shall have lugs or terminal fittings when not soldered. Lap joint/tack on soldering is not acceptable. All soldered connections shall be made with 60/40 solder and non-corrosive, non-conductive flux. All wiring shall be run neatly and shall use mechanical clamps and conductors shall not be spliced between terminations. Cables shall be sleeved in braided nylon mesh and wires shall not be exposed.

I. Load-Bay and Panel Wire Termination
All wires terminated behind the main panel or on the back side of other panels shall be SOLDERED. No pressure or solder-less connectors shall be used. Printed circuit boards shall only be used on the load bay where connecting to the bus interface units (BIU).

J. Cabinet Light Assembly
The cabinet shall have an LED lighting fixture with 15 high power LEDs using a cool white color emitting 300lm min @ 12VDC/750mA. The LED shall be a Rodeo Electronics TS-LED-05M02 or approved equivalent. The LED fixture shall be powered by a Mean Well class 2 power supply LPV-20-12 that shall be mounted on the inside top of the cabinet near the front edge. The cabinet light circuit shall be designed so a second LED fixture can be installed in the cabinet without the need of a second power supply. It shall be attached so that it remains stationary when drawer is extended. An on/off switch that is turned on when the cabinet door is opened and off when it is closed shall activate the lighting fixture(s) power supply.

K. Convenience Outlet
The cabinet shall be wired with one (1) convenience outlet with a ground fault interrupter (GFI) and two (2) quad convenience outlets without ground fault interrupters. The ground fault outlet (GFI) shall be mounted on the right side of the cabinet on or near the power panel. The quad convenience outlets shall be mounted on the right side at top of the “C” channel. No outlets shall be mounted on the door. The GFI power shall be fed through the auxiliary breaker. The quad convenience outlets shall be fed through the equipment breaker. Non-GFI receptacles shall be labeled “Electronic Equipment Only”.

L. Auxiliary Panel
The cabinet shall include an auxiliary switch panel mounted to the interior side of the police panel compartment on the cabinet door. The panel shall be secured to the police panel compartment by (2) screws and shall be hinged at the bottom to allow access to the soldered side of the switches with the use of only a Phillips screwdriver. Both sides of the panel shall be silkscreened. Silk-screening on the backside of the switch panel shall be upside down so that when the panel is opened for maintenance the silk-screening will be right side up. All of the switches shall be protected by a hinged see-through Plexiglas cover.

At a minimum the following switches shall be included:
1. **Controller ON/OFF Switch:** There shall be a switch that renders the controller and load-switching devices electrically dead while maintaining flashing operations for purpose of changing the controller or load-switching devices. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat.

2. **Signals ON/OFF Switch:** There shall be a switch that renders the field signal displays electrically dead while maintaining controller operation for purpose of monitoring controller operations. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat.

3. **Stop Time Switch:** There shall be a 3-position switch labeled “Normal” (up), “Off” (center), and “On” (down). With the switch in the “Normal” position, a stop timing command shall be applied to the controller by the police flash switch or the MMU (Malfunction Management Unit). When the switch is in its “Off” position, stop timing commands shall be removed from the controller. The “On” position shall cause the controller to stop time. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat. There shall be a red LED indicator light that illuminates when stop time is applied.

4. **Technician Flash Switch:** There shall be a switch that places the field signal displays in flashing operation while the controller continues to operate. This flash shall have no effect on the operation of the controller or MMU. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat.

5. **Vehicle Test Switches:** Eight (8) vehicle phase inputs shall have momentary pushbutton test switches with black caps. These switches shall be labeled 1, 2, 3, 4, 5, 6, 7, and 8. The switches shall terminate on an interface panel along with the 32 channel outputs of detector racks. The switches shall be programmable to any detector channel without the use of tools. The interface panel shall reside in the auxiliary panel.

6. **Pedestrian Test Switches:** Four (4) pedestrian phase inputs shall have momentary pushbutton test switches with black caps. These switches shall be labeled 2, 4, 6, and 8. Each switch shall have a red LED indicator light. These LED indicators are to provide indication as PPB is actuated, and shall be located directly above the respective switch.

7. **Preemption Test Switches:** Six (6) preempt inputs shall have momentary pushbutton test switches with red caps. These switches shall be labeled 1, 2, 3, 4, 5 & 6. Switch 5 shall be wired to rail road preempt circuit.

### M. Police Panel

Behind the police panel door there shall be switches for use by emergency personnel. The wiring for these switches shall be accessible when the auxiliary panel is open. The following switches shall be included:

1. **Flash Switch:** There shall be a switch for the police that puts the cabinet into flashing operations. The switch shall have two positions, “Auto” (up) and “Flash” (down). The “Auto” position shall allow normal signal operation. The “Flash” position shall immediately cause all signal displays to flash as programmed for emergency flash and apply stop time to the controller. When the police flash switch is returned to “Auto”, the controller shall restart except when the MMU
has commanded flash operation. The effect shall be to disable the police panel switch when the MMU has detected a malfunction and all controller and MMU indications shall be available to the technician regardless of the position of the police flash switch. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat.

2. **Signals ON/OFF Switch:** There shall be a switch that renders the field signal displays electrically dead while maintaining controller operation for purpose of monitoring controller operations. The switch shall be a general-purpose bat style toggle switch with .688-inch long bat.

**N. Cables**
All wire cable bundles shall be encased in flex or expandable braided sleeving along their entire free length.

All SDLC cables shall be terminated on both ends, securely terminated to the SDLC interface panel with screw type connection and professionally routed in the cabinet interior to easily reach the load bay, controller, malfunction management unit and detector racks. All SDLC connectors shall be fully populated with 15 pins each.

**O. Flashing Operation**
All cabinets shall be wired to flash for all vehicle channels. Flashing operation shall alternate between the used vehicle phases 1, 2, 3, 4, pedestrian phases 2, 4, OLC & OLD and 5, 6, 7, 8, pedestrian phases 6, 8, OLA & OLB. Flash programming shall be either red, yellow or no flash simply by changing wires on the front of the load-bay.

**P. Detector Racks**
At a minimum, the cabinet shall be wired to accommodate (32) channels of detection. One detector rack shall support (16) channels of loop detection, (1) Buss Interface Unit (BIU) and (4) channel of Opticom™. One detector rack shall support (16) channels of loop detection and one (1) Buss Interface Unit (BIU) and (4) channels of low priority preemption. Racks shall be capable of using both two channel or four channel detection devices or Opticom™ cards. The loop cabling shall be connected via a 37 pin DB connector using spring clips. The Opticom and low priority cable shall be connected via a 24 pin connector using locking latches. The power cable shall be a 6 pin connector. All power wires shall be 18AWG. The addressing of detector racks shall be accomplished via dipswitches mounted to the PCB. There shall be the capability to turn off the TS2 status to the BIU for the uses of TS1 detector equipment via dipswitches mounted to the PCB. There shall be a 34 pin connector using locking latches that breaks the output from the detector to the input of the BIU, there shall also be +24VDC and logic ground on this connector. All racks shall have space at the bottom front for labeling. All racks shall be designed for horizontal stacking. Separate racks for detection and preemption are not allowed.

**Q. Detection Panel**
The detection panel shall support (32) channels of vehicle detection, (4) channels of emergency vehicle preemption, (4) channel of low priority preemption detection, (8)
channels of pedestrian detection and (8) pedestrian returns and output and input for rail
road preemption circuit on a single panel. The pedestrian call terminal block shall be (2)
single row terminals. They shall be connected by removable buss bars. The loop wires
shall be a 22AWG twisted pair, color coded as follows. Channel one brown, channel two
red, channel three orange and channel four yellow. One of the twisted pair wires of all
colors shall have a white tracer and land on the second position terminal of each loop.
The emergency preempt and low priority preempt wires shall be color coded as follows.
+24VDC orange, preempt inputs yellow and ground blue. The auxiliary vehicle
preemption shall be white with a yellow tracer. This panel will be mounted on the left
side of the cabinet below the bottom shelf. The panel shall also include a (19) position
solid aluminum, tin plated neutral and ground buss bars with raised slotted & torque style
screws heads. They shall be mounted vertically at the bottom of the panel.

R. Power Supply Interface Panel
The power supply interface panel shall include terminations for all the cabinet power
supply inputs and outputs. It shall have a protective plastic cover. This panel shall be
mounted on the left wall of the cabinet.

S. Interconnect Terminal Panel
There shall be a 25 position terminal block with #6-32 screws part# 671RZ-25-PSB. It
shall be mounted vertically on the lower front of the blank panel above the surge
suppressor on the right wall of the cabinet.

T. Spare Panels
Sheet metal panels shall be installed in the available space on the upper left and right
sides of the main compartment.

U. Supplemental Loads
There shall be a supplemental load panel with (4) 2.5K-ohm, 10-watt panel mount
resistor. One side terminated to a (4) position terminal block tied to neutral. The other
side terminated to another (4) position terminal block. This block shall be left open for
future loading in the cabinet.

V. Service Surge Suppression
The cabinet shall be equipped with an Innovative Technologies model HS-P-SP-120-60A
or approved equivalent voltage suppressor mounted on above the power panel. Power to
all cabinet wiring shall come through this voltage suppression circuit.

W. Power Panel
The power panel shall handle all the power distribution and protection for the cabinet and
shall be mounted in the bottom right side of the facility. All equipment shall be mounted
on a 12” x 17” silkscreened aluminum panel and include at a minimum the following
equipment:
1. A 40-amp main breaker shall be supplied. This breaker shall supply power to the load bay, load switches and auxiliary panel. It shall also power via the EDCO SHP300-10, the controller, MMU, power supply & detector racks.
2. A 20-amp equipment breaker shall supply power to the convenience outlets.
3. A 15-amp auxiliary breaker shall supply power to the fan, light and GFI.
4. A 50-amp, 125 VAC radio interference line filter.
5. (6) 10-amp spare breakers.
6. A normally open, 50-amp, solid-state relay. The relay shall have a green LED light that is on when energized. (No Mercury Contactors shall be allowed)
7. One see-through Plexiglas cover on stand-offs to protect maintenance personnel from AC line voltages. This shall be removable by loosening screws but without removing screws.
8. Two (19) position solid aluminum, tin plated neutral buss bar with raised slotted & torque style screw heads.
9. One (19) position solid aluminum, tin plated ground buss bar with raised slotted & torque style screw heads.
10. Two MOVs shall be terminated on the 120AC in field terminal. One tied between line and ground, the other between neutral and ground.

X. Cabinet Components

1. **Malfunction Management Unit (MMU):** The cabinet shall come with a (MMU) that meets all the requirements of NEMA TS2-2003 while remaining downward compatible with NEMA TS1. It shall have (2) high contrast LCD displays and an internal diagnostic wizard. It shall come with a 10/100 Ethernet port. It shall come with software to run flashing yellow arrow operation. The MMU shall be an Eberle Design, Inc. model MMU2-16LEip or approved equivalent.
2. **Loop Detector:** The cabinet shall come with the necessary amount of NEMA TS2 Type A, two-channel, solid state inductive loop detectors required for the operation of the signalized intersection. The detector shall provide a push-button interface and a display showing the relative strength of the vehicle call, operational mode and frequency. The detector shall support the capability to program the unit in one step utilizing the presence of one mid-size vehicle over the roadway loop. The detector shall support up to four operating frequency levels. The detector shall be able to display and report three types of loop faults: open loops, shorted loops, and 25% sudden changes in inductance. The detector shall be Eberle Design, Inc. model LMD622 or approved equivalent.
3. **Load Switch:** The cabinet shall come with (16) load switches. All load switches shall be discreet type and have LED indications for both the input and output side of the load. The load switches shall be PDC model SSS-86I/O or approved equivalent.
4. **Flasher:** The cabinet shall come with (1) flasher. The flasher shall be discrete type and have LED indications. The flasher shall be PDC model SSF-86-3 or approved equivalent.
5. **Flasher Transfer Relay:** The cabinet shall come with (8) heavy duty flash transfer relays. The relays shall be Detrol Controls model 295 or approved equivalent.

6. **Bus Interface Unit (BIU):** The cabinet shall come with (4) bus interface units (BIU). These shall meet all the requirements of NEMA TS-2 1988 standards. In addition, all BIUs shall provide separate front panel indicator LED’s for DC power status and SDLC Port 1 transmit and receive status. The BIUs shall be Eberle Design, Inc. model BIU700 or approved equivalent.

7. **Power Supply (PS):** The cabinet shall come with a shelf mounted cabinet power supply meeting at minimum TS 2-2003 standards. It shall be a heavy duty device that provides +12VDC at 5 Amps / +24VDC at 2 Amps / 12VAC at .25 Amp, and line frequency reference at 50 mA. The power supply shall provide a separate front panel indicator LED for each of the four outputs. Front panel banana jack test points for 24VDC and logic ground shall also be provided. The power supply shall provide 2A of power and be able to cover the load of two (2) complete detector racks. The power supply shall be Eberle Design, Inc. model PS250 or approved equivalent.

8. **Manuals & Documentation:** The cabinet shall be furnished with (3) complete sets of cabinet prints. All cabinet wiring, and layout shall come on (1) E1 size sheet, multiple pages shall not be allowed. Upon request, (1) CDROM with AutoCAD v2008 cabinet drawing for the cabinet wiring shall be provided.